Sullivan County Oil Field.

By Edward Barrett.

Fifteen years ago, the people of Indiana generally believed that Trenton rock was the only gas and oil producing formation in the State. The large production of both gas and oil during the fifteen years following 1889 in the old Trenton rock field led to a period of marvelous industrial and commercial activity in that portion of the State, and this activity heightened the belief that the Trenton was the only rock worth exploiting for oil and gas.

So long as these conditions prevailed, little systematic or determined effort was made by drillers and operators to find gas or oil in other parts of the State, or in formations other than the Trenton. As soon, however, as the Trenton production began to decline, and the industries of the Trenton field began to be threatened with a shortage of fuel, exploitation for gas and oil took on more intelligent, exact, and even more scientific methods. The fact had become generally known that Trenton rock in the oil field was at a depth of about one thousand feet, and this fact formed the basis for work.

Then exploitation began in other parts of the State and in other formations than the Trenton, drillers and operators sought information as to stratagraphic and structural relations of formations, sea level datum, and the geologic conditions governing the accumulation of gas and oil.

For more than a quarter of a century it had been an established fact that the following conditions governing the accumulation of gas and oil must exist:

1. A porous reservoir (formation) to hold the gas and oil.
2. An impervious cover (usually shale) above to hold gas or oil.
3. An anticline, dome, or pool as a reservoir.
4. A force, or pressure, behind the oil or gas to force them into the reservoir, or out of it through the drill hole or well.

After the decline of gas and oil in the old Trenton field, the four conditions mentioned above were sought with renewed emphasis in new fields, such as Princeton, Oakland City, Lyons, and later Sullivan County.

Although sufficient data have not been gathered to establish the existence of anticlines or even domes in the above mentioned fields, there is no doubt of the existence of the first, second and fourth conditions enumerated above. It is possible for oil or gas to exist in a formation without an anticline or dome, but it is not possible for it to exist without (1) a porous reservoir, and (2) an impervious cover, and (3) pressure behind the oil and gas.

Since the oil and gas in the Sullivan field occur in pools of the Huron limestone and sandstone, the above conditions of accumulation, confinement and pressure must exist.

Areally the Sullivan County, Indiana, oil and gas field is wholly within the Pennsylvania system or Carboniferous system of rocks. Sullivan County lies on the extreme eastern margin of the great interior coal basin, which extends throughout southwestern Indiana, eastern Kentucky and southern Illinois.

The oil and gas are doubtless found in the Huron formation, which consists of limestones and sandstones. The Huron is the topmost member of the Mississippi system of rocks, and lies just below the Mansfield sandstone, the basal member of the Carboniferous or coal measures. The oil and gas in the Princeton field and the Oakland City field to the south are doubtless from the same formation.

The Huron of Indiana is correlated with the Kirkwood sand of Lawrence County, Illinois. According to the Illinois Geological Survey, the Kirkwood sand is the most widespread producing horizon in Illinois, as well as in Lawrence County. The Kirkwood sand in Illinois "shows excellent initial production and long continued yield, and is the most reliable of all sands." It is barely possible that some of the oil and gas of Sullivan County comes from the lower portion of the Mansfield sandstone.

It is a well-known fact by drillers, operators and geologists that in the absence of anticlines or domes for the accumulation of oil and gas that such accumulation occurs in pools, and it seems that this is the prevailing condition in the Sullivan field. By pools, we do not mean recesses or caverns filled with oil, in the limestone or sandstone. The expression is used simply to express variation in the structure of a formation. Oil and gas occupy space like any other matter. There are variations in the structure of limestone and sandstone, some being of a fine, close-grained character, and others being of the loose and friable character. In other words, the spaces or interstices among the particles in some

sandstones and limestones are larger than others. Hence the accumulation of oil or gas would be in the portions of the formation where the spaces between the particles of sand were the largest. Little or no oil or gas would accumulate in the close-grained portion, and this part of the formation might form in a manner a partition between different pools. If the driller puts down a well that strikes one of these pools, the chances are that oil or gas will be found. If the drill happens to strike between the pools in the close-grained part of the formation, a dry hole will be the result. These so-called pools may vary in size and form according to the structure of the formation in which they occur.

The State Geologist at the present writing, in the absence of sufficient data to establish an anticline or any portion of an anticline in Sullivan County, believes that the oil and gas occur as described above.

From the time of the earliest activity in oil and gas in other parts of the State, more or less prospecting and wildcatting was done in Sullivan County, but it was not until the middle of the year 1913 that wells of sufficient production were found in the county to justify liberal prices for leases and liberal investment in oil properties.

In October, 1913, the State Geologist with two assistants ran a line of levels from the north end of Sullivan County southward through the productive territory, almost to the south boundary of the county. Many operators have taken advantage of the levels thus run to estimate the probable depth of pay sand in territory on either side of the line. The Department of Geology never before had undertaken work of this kind, so far as the writer has any knowledge. In the Twenty-fifth Annual Report of the Department of Geology, the following statements are made concerning the importance of surface levels, pages 485 and 486. The statements made are applied to the Trenton rock in the old oil and gas field, but they are equally true of the pay sand in Sullivan County.

"*Necessity of Accurate Surface Levels.*—Where a bore for petroleum has resulted in a good producing well, the level of the surface of the Trenton rock below tide should be carefully ascertained. This can be done only by running a transit level from the nearest point where the surface level is known, usually on a railway, to the surface of the bore. By subtracting the surface level of the bore from the depth at which Trenton limestone is first

struck, the surface level of the latter will be obtained. In but few places in the State is Trenton found above sea level. Where so found the depth to Trenton will be less than the surface level of the bore, and should be subtracted accordingly.

"The location of the first dozen or more wells in any area a mile or two square must of necessity be largely a matter of guess work, but if the surface level of the Trenton in each bore, productive or dry, be carefully ascertained, the trend of the anticline and the approximate limits of the field or pool can be soon determined. Too much guesswork concerning the surface level of the spot on which the well is located has been done in the past. In a broken country it is difficult for any man to guess approximately at the relative levels of two points a quarter of a mile apart, and the new level should always be ascertained with instruments. Of course the surface level of the bore has nothing to do with the absolute height or surface level of the Trenton, or the absence or presence of the petroleum, but it has a great deal to do with the accurate determination of the surface level of the Trenton, and therefore with the location of future wells. If a few thousand dollars had been spent in Indiana in past days in the careful determination of surface levels, it would have saved a few hundred thousand which have been sunk in dry holes."

The altitude indicated by a bench mark located at the northwest corner of the court house yard Sullivan, Indiana, by the U. S. Geological Survey was taken as the initial datum. From this altitude a transit level was run to a point at the southeast corner of Turman Township, elevation 531.09. This altitude was taken as the datum for the line of elevations running north to the northern boundary of Sullivan County and south to the southern boundary. Few if any of the producing wells of Sullivan County are less than 600 feet deep; therefore the productive sand is below sea level. Other altitudes established are as follows, running north from the above mentioned point:

Stone at intersection of S. Graysville road with N. and S. township line at base of gatepost on S. side of road. Post marked I. G. S. (Indiana Geological Survey) 537.68 Stone. Section 30, Hamilton Township, S. W. corner.

B. M. 1 miles from B. M. No. N. 3. Oak tree W. of S. W. corner red barn E. side of road. Marked I. G. S. 520.91. Section 19, Hamilton Township, S. W. corner.

Corner fence post on township fence line N. side of N. Grays-

ville road marked with nails I. G. S. 518.85. Sec. 18, Hamilton Township, S. W. corner.

Stone 3 rods 3 feet N. of section stone on township line in line with E. and W. fence line to the E. 500 feet. Sec. and S. L. stones between two locust trees. Marked I. G. S. 525.63. Sec. 10, Hamilton Township, N. W. corner.

Section stone N. W. corner Sec. 7. S. side of fence on south side of road on G. W. Osborne's farm. Marked I. G. S. 529.24. N. W. corner Sec. 7, Hamilton Township.

Beech tree blazed on E. side, N. W. corner of Hamilton Township and of W. T. Dix farm. S. side of E. and W. road. Marked I. G. S. 483.34. N. W. corner Sec. 6, Hamilton Township.

Corner fence post N. side of E. and W. road, W. side of N. and S. township line road. Marked on E. side of post I. G. S. 518.87. S. E. corner Sec. 25, Fairbanks Township.

Maple tree 15 feet E. of N. E. corner of iron bridge on township line road and Turman Creek. Tree blazed on W. side I. G. S. 478.28. S. W. corner Sec. 19, Curry Township.

Fence post 15 feet W. of Sec. stone W. side of township line road. Marked I. G. S. 526.07. N. E. corner Sec. 24, Fairbanks Township.

Fence post at N. W. corner Sec. 18 Curry Township. S. side of E. and W. North boundary road of Sec. 18 and on E. side of township line road. Marked I. G. S. 532.15. N. W. corner Sec. 18, Curry Township.

Levels from S. E. corner of Turman Township south to county line along township fence line.

Brown pebble in concrete base of and on N. W. side of corner fence post at intersection of S. line of Sec. 1, Gill Township and township line. Post marked I. G. S. 527.70. S. E. corner Sec. 1, Gill township.

Concrete base on S. E. side of corner post at intersection of township line with S. line of Sec. 7, Hamilton Township, N. side of E. and W. road. Concrete marked I. G. S. 516.99. S. W. corner Sec. 7, Hamilton Township.

Stone at S. W. corner of Hamilton Township, 1 foot south of corner fence post N. side of road. Marked I. G. S. 501.46 S. W. corner Sec. 18, Hamilton Township.

Cedar post 9 feet W. of corner stone at S. E. corner of Section 24, Gill Township. Marked on S. E. side I. G. S. 480.82, S. E. corner Sec. 24, Gill Township.

Oak tree half way between ½ Sec. line E. and W. and N. Sec. line E. and W. of Sec. 31 and 400 feet E. of W. N. and S. Sec. line of Sec. 31, Gill Township. Tree 25 feet W. of S. W. corner of house. Marked I. G. S. 468.07. W. middle Sec. 31, Gill Township. Post end of N. and S. fence on S. side of dividing E. and W. road between Gill and Haddon townships, .25 mile E. of township line. Marked I. G. S. 468.07. N. W. quarter Sec. 6, Haddon Township.

Oak tree 45 feet S. of E. and W. road at point where it jogs N. road is E. and W. half section line of Sec. 12, Gill Township. Tree at intersection of ½ section line and township line. Tree blazed upon root on N. side. I. G. S. 443.72. E. center Sec. 12, Gill Township.

Cornerstone S. E. corner Sec. 13, Gill Township. E. side of E. and W. road at point of jog N. at township line. Marked 435.89 I. G. S. S. E. corner Sec. 13, Gill Township.

S. W. pier of bridge across Busseron Creek ½ mile S. of E. and W. township dividing line on S. side of Gill, dividing Gill and Haddon. Road across bridge is E. boundary of Sec. 26, Haddon Township. E. center Sec. 26, Haddon Township. Reading at top of pier: 427.45.

ELEVATIONS ON THE EVANSVILLE AND TERRE HAUTE RAILROAD IN SULLIVAN COUNTY, NORTH AND SOUTH OF SULLIVAN.

North.

Sullivan	539.0
Union Mine	512.0
Mildred Mine	516.0
Shelburn	541.0
Standard	559.0

South.

Sullivan	539.0
Paxton	489.0
Carlisle	482.0
Bellevue Mine	464.0

The elevations and bench marks established by the Indiana Geological Survey in 1913 mentioned above show a difference of approximately 100 feet in the surface elevation from the north end of the county to the south end. The difference in elevation along the Evansville and Terre Haute Railroad from the north

end of the county to the south is approximately 100 feet. These figures are important only in showing the surface slope of the county to the southwest but it is a strange coincidence that the pay sand along the line of levels established by the Indiana Geological Survey is found, as a rule, deeper as we go southward. Pay sand is found in Curry Township in the north at 560 feet; in Gill Township in the south it is found at 940 feet. These figures show a violent dip of the pay sands to the southwest.

This difference in depth at which pay sand is found in the north and south ends of the county can hardly be accounted for on the ground that the drill probably penetrated the sand to greater depth in the wells in the south end of the county than in the wells in the north end. The figures do not necessarily show that the wells are located on the slope of an anticline nor on the side of a dome. We have just as good reason to say that the figures show that the "pools" mentioned above are found at different depths.

Herewith, are submitted a list of well records showing varying depths of pay sand, and the different formations encountered in reaching it.

The principal operating companies are the Ohio Oil Co., W. T. Kennedy & Co., Henderson & Snyder, Riggs & Oliphant, Bays Bros., Hamilton Oil and Gas Co., E. R. T. Producing Co., James Crawford Co., T. Colt Co.

Record of well drilled on J. Hoesman farm, N. E. ¼ N. E. ¼, Sec. 20, Gill Township, Sullivan County. Drilled by John T. Hays, S. A. White and J. R. Riggs, and others, 1904:

PIPE RECORD.

10-inch drive pipe	78 feet
8¼-inch drive pipe	250 feet
6¼-inch drive pipe	610 feet
Coal	230 to 235 feet
Coal No. 7	285 to 290 feet
Gas sand	375 to 385 feet
Gas sand	470 to 475 feet
Salt water sand	540 to 560 feet
Salt water sand	630 to 650 feet
Shale	650 to 660 feet
Coal	660 to 663 feet
Shale	750 to 820 feet
Sand, showing oil	820 to 869 feet
Shale	869 to 900 feet
Salt water sand	900 to 905 feet

Total depth of hole, 905 feet.

Record of well drilled on J. Hoesman farm, N. E. corner S. E. ¼, Sec. 9, Gill Township, Sullivan County. Drilled by Fred Boden, 1906:

PIPE RECORD.

10-inch drive pipe	45 feet	
8¼-inch drive pipe	410 feet	
6¼-inch drive pipe	920 feet	
Coal	210 to	215 feet
Gas shale		460 feet
Salt water sand	595 to	630 feet
Oil and gas sand	745 to	760 feet
Shale	760 to	820 feet
Salt water sand	820 to	905 feet
Shale	905 to	1,100 feet
Sand	1,100 to	1,120 feet
Shale	1,120 to	1,202 feet

Total depth, 1,202 feet.

This well was ruined by shot and failure to get water cased off. Well showed to be about a ten-barrel well.

N. W. corner N. E. ¼, Sec. 8, Township 8 north, range 10 west, Turman Township. Drillings by Dodd Bridge:

Rock		26 feet
Shale	26 to	70 feet
Sand	70 to	80 feet
Shale	80 to	255 feet
Coal (5 feet of coal)	255 to	260 feet
Shale	260 to	305 feet
Coal	305 to	310 feet
Limestone	310 to	340 feet
Shale	340 to	510 feet
Sand	510 to	570 feet
Shale	570 to	585 feet
Sand (quick or water sand)	585 to	680 feet
Sand	680 to	690 feet
Shale	690 to	910 feet
Salt sand	910 to	960 feet
Shale	960 to	965 feet
Black sand	965 to	985 feet
White sand	985 to	1,090 feet
Shale	1,090 to	1,110 feet
St. Mary's sand or pay sand	1,110 to	1,130 feet
Black slate	1,130 to	1,140 feet
Blue sand	1,140 to	1,210 feet
Limestone	1,210 to	1,230 feet
Black slate	1,230 to	1,270 feet
Gray sand	1,270 to	1,290 feet
Limestone	1,290 to	1,460 feet
Brown oil sand	1,460 to	1,475 feet
Limestone	1,475 to	1,585 feet
Blue Lick sand	1,585 to	1,762 feet

Record of bore drilled on Simpson Edward's farm, N. ½ N. ½ S. W. ¼, Sec. 10, Gill Township, Sullivan County. Drilled by E. R. Riggs, 1911:

PIPE RECORD.

10-inch drive pipe	25 feet
8¼-inch drive pipe	360 feet
6¼-inch drive pipe	728 feet

Coal No. 8	90 to	93 feet
Coal No. 6	330 to	333 feet
Sand, some gas	470 to	555 feet
Sand, showing oil	500 to	515 feet
Shale	555 to	570 feet
Sandy, gritty shale	570 to	585 feet
Coal No. 3	585 to	590 feet
Shale	590 to	605 feet
Coal	605 to	610 feet
Shale	610 to	625 feet
Sandy shale	625 to	640 feet
Shale	640 to	670 feet
Salt water sand	670 to	690 feet
Shale	690 to	722 feet
Sand	722 to	726 feet
Shale	726 to	771 feet
Oil sand	771 to	780 feet
Shale	780 to	782 feet

Total depth, 782 feet.

Shot forty (40) quarts. Well started off at twenty (20) barrels per day. Now running two (2) barrels.

There are three producing wells on this farm and one dry hole.

Record of bore sunk on J. Hoesman farm, N. E. ¼ S. E. ¼, Sec. 9, Gill Township, Sullivan County. Drilled by E. R. Riggs, 1911:

PIPE RECORD.

10-inch drive pipe	28 feet
8¼-inch drive pipe	451 feet
6¼-inch drive pipe	720 feet

Drift	4 feet	
Loose sand and gravel	24 feet	28 feet
White shale	42 feet	70 feet
Sand, fresh water	35 feet	105 feet
Coal No. 8	2 feet	107 feet
Shale	93 feet	200 feet
Limestone	12 feet	212 feet
Shale	8 feet	220 feet
Limestone	8 feet	228 feet
Shale	32 feet	260 feet
Soft limestone	20 feet	280 feet
Shale	55 feet	335 feet
Coal No. 6	3 feet	338 feet

Shale	82 feet	420 feet
Coal No. 5	1 foot	421 feet
Shale	64 feet	485 feet
Sand, dry	7 feet	492 feet
Brown shale	128 feet	620 feet
Salt sand, water	10 feet	630 feet
Shale	40 feet	670 feet
Salt sand, water	25 feet	695 feet
Brown shale	72½ feet	767½ feet
Sand, broken, showing oil	14½ feet	782 feet
Shale	99 feet	791 feet
Shale	14 feet	805 feet

Total, 805 feet.

Shot twenty (20) quarts, well showing about two (2) barrels.

Record of well drilled on J. B. Kaufman farm, N. E. corner Sec. 16, Gill Township, Sullivan County. Drilled January, 1912, by E. R. Riggs:

PIPE RECORD.

10-inch drive pipe	45 feet
8¼-inch drive pipe	350 feet
6¼-inch drive pipe	740 feet

Coal No. 8	110 to 117 feet
Coal No. 6	340 to 346 feet
Gas sand	385 to 395 feet
Sand	475 to 495 feet
Shale	495 to 625 feet
Sand	625 to 645 feet
Shale	645 to 665 feet
Salt water sand	665 to 690 feet
Shale	690 to 770 feet
Dry sand	770 to 777 feet
Shale	777 to 822 feet
Sand showing oil	822 to 826 feet
Shale	826 to 830 feet
Sand showing oil	830 to 835 feet
Shale	835 to 837 feet
Sand showing oil	837 to 842 feet
Shale	842 to 844 feet
Salt water sand	844 to 851 feet

Total depth of well, 851 feet.

Possibly would have made five (5) barrel well with shot.

Record of well drilled on Anderson farm, S. E. corner Sec. 28, Gill Township, Sullivan County. Well drilled by Burton Bros. and E. R. Riggs, 1912:

PIPE RECORD.

10-inch drive pipe	65 feet
8¼-inch drive pipe	265 feet
6¼-inch drive pipe	730 feet

Gravel	65 feet
Coal	235 to 236 feet
Coal No. 7	285 to 290 feet
Coal No. 6	340 to 346 feet
Sand, 300,000 feet.	
Gas	350 to 362 feet
Shale	362 to 570 feet
Salt water sand	570 to 670 feet
Shale	670 to 695 feet
Coal	695 to 697 feet
Shale	697 to 720 feet
Lime	720 to 728 feet
Shale	728 to 760 feet
Sand, dry	760 to 790 feet
Black shale	790 to 864 feet
Lime	864 to 866 feet
Sand, dry	866 to 871 feet
Shale	871 to 874 feet
Dry sand	874 to 890 feet
Shale	890 to 935 feet
Sand, salt water	935 to 944 feet

Total depth of hole, 944 feet.

WELL No. 1.

Farm of H. Heim, Sec. 36, Fairbanks Township, Sullivan County, 200 feet from S. line, 200 feet from E. line.

Contractor, W. T. Erdman.
Commenced drilling August 22, 1913.
Completed drilling August 30, 1913.
Casing, 565 feet of 6¼ inch.
Top sand, 612 feet.
Best oil, 620 feet.
Total depth, 630 feet.
First 24 hours production, 150 barrels.
Second 24 hours production, 125 barrels.

WELL No. 2.

Farm of H. Heim, Sec. 36, Fairbanks Township, Sullivan County, 580 feet from S. line, 200 feet from E. line.

Contractor, S. V. Cawley.
Commenced drilling August 22, 1913.
Completed drilling August 29, 1913.
Casing, 560 feet of 6¼ inch.
Top sand, 606 feet.
Best oil, 615 feet.
Total depth, 625 feet.
First 24 hours production, 250 barrels.
Second 24 hours production, 200 barrels.

Record of bore drilled on Beard farm, N. E. corner S. E. ¼ N. W. ½, Sec. 1, Turman Township, Sullivan County. Well No. 1 drilled by J. R. Riggs, E. R. Riggs, Fred F. Bays and Lee Bays, September, 1913:

PIPE RECORD.

10-inch drive pipe	25 feet
8¼-inch drive pipe	145 feet
6¼-inch drive pipe	505 feet
Coal No. 7	60 to 62 feet
Coal No. 6	120 to 126 feet
Coal	171 to 172 feet
Coal No. 4	262 to 266 feet
Sand	293 to 400 feet
1,000,000 feet gas	300 to 320 feet
Water	320 to 360 feet
Shale	400 to 450 feet
Coal No. 3	450 to 452 feet
Firestone	452 to 457 feet
Shale	457 to 483 feet
Coal	483 to 488 feet
Shale	488 to 502 feet
Lime	502 to 525 feet
Shale	525 to 549 feet
Hard sand	549 to 550 feet
Gas sand	550 to 560 feet

4,000,000 feet gas.
290-pound rock pressure.
Total depth, 560 feet.

This well is one-half (½) mile in advance to west of Shelburn pool.

No. 6 ranges 150 to 200 in pool and is 40 to 100 feet deeper, one to two miles away in every direction from pool.

Pay sand in majority of Shelburn pool weels is found from 595 to 650 feet.

WELL No. 4.

Farm of H. Heim, Sec. 36, Fairbanks Township, Sullivan County, 200 feet from S. line, 660 feet from E. line.

Contractor, F. F. Williams.
Commenced drilling September 11, 1913.
Completed drilling September 20, 1913.
Casing, 560 feet of 6¼ inch.
Top sand, 607 feet.
Best oil, 615 feet.
Total depth, 629 feet.
First 24 hours production, 200 barrels.
Second 24 hours production, 150 barrels.

Record of well drilled on Sanders farm by the Hamilton Gas and Oil Company. Sec. 31, Hamilton Township, Sullivan County. No. 4 well completed September 24, 1913.

PIPE RECORD.

10-inch drive pipe	30 feet
8¼-inch drive pipe	300 feet
6¼-inch drive pipe	716 feet
Coal No. 6	260 feet
Sand showing oil	480 to 500 feet
First pay sand	743 to 751 feet
Second pay sand	661 to 671 feet

Shot each day with forty (40) quarts. Pumped ninety (90) barrels first twenty-four hours.

WELL No. 1.

Farm of Josephine Dix, Sec. 1, Turman Township, Sullivan County, 200 feet from N. line, 200 feet from E. line.

Contractor, Claude Hoover.
Commenced drilling September 21, 1913.
Completed drilling October 4, 1913.
Casing, 573 feet of 6¼ inch.
Top sand, 606 feet.
Best oil, 612 feet.
Total depth, 650½ feet.
First 24 hours production, 200 barrels.
Second 24 hours production, 45 barrels.

WELL No. 3.

Farm of H. Heim, Sec. 36, Fairbanks Township, Sullivan County, 275 feet from E. line, 200 feet from N. line.

Contractor, W. T. Erdman.
Commenced drilling September 25, 1913.
Completed drilling October 9, 1913.
Casing, 560 feet of 6¼ inch.
Top sand, 611 feet.
Best oil, 615 feet.
Total depth, 637½ feet.
First 24 hours production, 200 barrels.
Second 24 hours production, 200 barrels.

WELL No. 5.

Farm of H. Heim, Sec. 36, Fairbanks Township, Sullivan County, 200 feet from S. line, 200 feet from W. line.

Contractor, F. F. Williams.
Commenced drilling October 2, 1913.
Completed drilling October 15, 1913.
Casing, 560 feet of 6¼ inch.

Top sand, 610 feet.
Best oil, 620 feet.
Total depth, 660 feet.
First 24 hours production, 350 barrels.
Second 24 hours production, 200 barrels.

WELL No. 6.

Farm of H. Heim, Sec. 36, Fairbanks Township, Sullivan County, 660 feet from S. line, 660 feet from E. line.

Contractor, F. F. Williams.
Commenced drilling October 9, 1913.
Completed drilling October 18, 1913.
Casing, 570 feet of 6¼ inch.
Top sand, 615 feet.
Best oil, 620 feet.
Total depth, 650 feet.
First 24 hours production, 350 barrels.
Second 24 hours production, 150 barrels.

WELL No. 4.

Farm of Josephine Dix, Sec. 1, Turman Township, Sullivan County, 1,120 feet from N. line, 200 feet from E. line.

Contractor, Fred Ward.
Commenced drilling October 16, 1913.
Completed drilling November 3, 1913.
Casing 606 feet of 6¼ inch.
Top sand, 610 feet.
Best oil, 643 feet.
Total depth, 676 feet.
First 24 hours production, 170 barrels.
Second 24 hours production, 85 barrels.

WELL No. 2.

Farm of M. J. Beard, Sec. 36, Fairbanks Township, Sullivan County, 200 feet from E. line, 200 feet from S. line.

Contractor, Claude Hoover.
Commenced drilling October 10, 1913.
Completed drilling November 7, 1913.
Casing, 564 feet of 6¼ inch.
Top sand, 617 feet.
Best oil, 623 feet.
Total depth, 647 feet.
First 24 hours production, 210 barrels.
Second 24 hours production, 160 barrels.

WELL No. 7.

Farm of H. Heim, Sec. 36, Fairbanks Township, Sullivan County, 660 feet from E. line, 200 feet from N. line.

Contractor, W. T. Erdman.
Commenced drilling October 22, 1913.
Completed drilling November 4, 1913.
Casing, 600 feet of 6¼ inch.
Top sand, 626 feet.
Best oil, 640 feet.
Total depth, 659 feet.
First 24 hours production, 200 barrels.
Second 24 hours production, 150 barrels.

WELL No. 8.

Farm of H. Heim, Sec. 36, Fairbanks Township, Sullivan County, 200 feet from N. line, 200 feet from W. line.

Contractor, F. F. Williams.
Commenced drilling October 25, 1913.
Completed drilling November 7, 1913.
Casing, 575 feet of 6¼ inch.
Top sand, 624 feet.
Best oil, 625 feet.
Total depth, 650 feet.
First 24 hours production, 185 barrels.
Second 24 hours production, 125 barrels.

WELL No. 1.

Farm of W. W. Harris, Sec. 1, Turman Township, Sullivan County, 200 feet from N. line, 200 feet from E. line.

Contractor, J. M. Huggins.
Commenced drilling November 5, 1913.
Completed drilling November 24, 1913.
Casing, 560 feet of 6½ inch.
Top sand, 656 feet.
Best oil, 668 feet.
Total depth, 733 feet.
First 24 hours production, 45 barrels.
Second 24 hours production, 15 barrels.

WELL No. 5.

Farm of Josephine Dix, Sec. 1, Turman Township, Sullivan County, 1,200 feet from N. line, 200 feet from E. line.

Contractor, F. F. Williams.
Commenced drilling November 12, 1913.
Completed drilling November 22, 1913.
Casing 556 feet of 6¼ inch.

Top sand, 608 feet.
Best oil, 675 feet.
Total depth, 705 feet.
First 24 hours production, 35 barrels.
Second 24 hours production, 20 barrels.

WELL No. 6.

Farm of Josephine Dix, Sec. 1, Turman Township, Sullivan County, 200 feet from E. line, 200 feet from S. line.

Contractor, Fred Ward.
Commenced drilling November 20, 1913.
Completed drilling December 5, 1913.
Casing, 583 feet of 6½ inch.
Top sand, 631 feet.
Best oil, 645 feet.
Total depth, 671 feet.
First 24 hours production, 75 barrels.
Second 24 hours production, 35 barrels.

WELL No. 2.

Farm of F. J. Harris, Sec. 1, Turman Township, Sullivan County, 200 feet from N. line, 200 feet from E. line.

Contractor, Fred Ward.
Commenced drilling December 11, 1913.
Completed drilling January 1, 1914.
Casing, 614 feet of 6¼ inch.
Top sand, 646 feet.
Best oil, 655 feet.
Total depth, 687 feet.
First 24 hours production, 150 barrels.
Second 24 hours production, 120 barrels.

WELL No. 1.

Farm of C. E. Merrill, Sec. 36, Fairbanks Township, Sullivan County, 200 feet from S. line, 200 feet from W. line.

Contractor, H. Heim.
Commenced drilling December 31, 1913.
Completed drilling January 9, 1914.
Casing, 566 feet of 6½ inch.
Top sand, 663 feet.
Best oil, 670 feet.
Total depth, 678 feet.
First 24 hours production, 70 barrels.
Second 24 hours production, 50 barrels.

WELL No. 7.

Farm of Josephine Dix, Sec. 1, Turman Township, Sullivan County, 200 feet from E. line, 970 feet from S. line.

Contractor, F. F. Williams.
Commenced drilling December 10, 1913.
Completed drilling January 5, 1914.
Casing, 568 feet of 6¼ inch.
Top sand, 630 feet.
Best oil, 631 feet.
Total depth, 673 feet.
First 24 hours production, 110 barrels.
Second 24 hours production, 80 barrels.

WELL No. 2.

Farm of Josephine Dix, Sec. 1, Turman Township, Sullivan County, 1,120 feet from S. line, 200 feet from W. line.

Contractor, Lawrence Henderhan.
Commenced drilling December 13, 1913.
Completed drilling January 7, 1914.
Casing, 105 feet of 6½ inch.
Top sand, 632 feet.
Best oil, 632 feet.
Total depth, 676 feet.
First 24 hours production, 80 barrels.
Second 24 hours production, 60 barrels.

WELL No. 1.

Farm of S. A. Merrill, Sec. 36, Fairbanks Township, Sullivan County, 200 feet from N. line, 200 feet from W. line.

Contractor, Sam Shearard.
Commenced drilling January 26, 1914.
Completed drilling March 6, 1914.
Casing, 592 feet of 6¼ inch.
Six feet coal at 205 feet.
Three feet coal at 320 feet.
Two feet coal at 540 feet.
Top sand, 709 feet.
Best oil, 709 feet.
Total depth, 718½ feet.
First 24 hours production, 50 barrels.
Second 24 hours production, 30 barrels.

WELL No. 5.

Farm of F. J. Harris, Sec. 1, Turman Township, Sullivan County, 125 feet from E. line, 386 feet from N. line.

Contractor, Fred Ward.
Commenced drilling January 30, 1914.

Completed drilling February 11, 1914.
Casing, 580½ feet of 6¼ inch.
Five feet of coal at 150 feet.
Five feet of coal at 315 feet.
Three feet of coal at 540 feet.
Top sand, 637 feet.
Best oil, 639 feet.
Total depth, 679 feet.
First 24 hours production, 160 barrels.
Second 24 hours production, 145 barrels.

WELL No. 4.

Farm of F. J. Harris, Sec. 1, Turman Township, Sullivan County, 660 feet from N. line, 200 feet from E. line.

Contractor, Fred Ward.
Commenced drilling January 14, 1914.
Completed drilling January 23, 1914.
Casing, 575 feet of 6¼ inch.
Two feet of coal at 150 feet.
Three feet of coal at 195 feet.
Five feet of coal at 315 feet.
Five feet of coal at 430 feet.
Three feet of coal at 510 feet.
Top sand, 638 feet.
Best oil, 638 feet.
Total depth, 679 feet.
First 24 hours production, 140 barrels.
Second 24 hours production, 120 barrels.

WELL No. 9.

Farm of Josephine Dix, Sec. 1, Turman Township, Sullivan County, 553 feet from S. line, 195 feet from E. line.

Contractor, F. F. Williams.
Commenced drilling January 20, 1914.
Completed drilling February 3, 1914.
Casing, 575 feet of 6¼ inch.
Five feet coal at 225 feet.
Five feet coal at 460 feet.
Four feet coal at 565 feet.
Top sand, 626 feet.
Best oil, 626 feet.
Total depth, 640 feet.
First 24 hours production, 125 barrels.
Second 24 hours production, 80 barrels.

WELL No. 2.

Farm of C. E. Merrill, Sec. 36, Fairbanks Township, Sullivan County, 200 feet from S. line, 510 feet from W. line.

Contractor, H. Heim & Co.
Commenced drilling March 2, 1914.
Completed drilling March 19, 1914.
Casing, 595 feet of 6¼ inch.
Top sand, 660 feet.
Best oil, 665 feet.
Total depth, 680 feet.
First 24 hours production, 130 barrels.
Second 24 hours production, 120 barrels.

WELL No. 1.

Farm of H. H. Burton, Sec. 28, Turman Township, Sullivan County, 365 feet from E. line, 200 feet from S. line.

Contractor, H. H. Adkins.
Commenced drilling January 15, 1914.
Completed drilling January 28, 1914.
Casing, 720 feet of 6¼ inch.
Top sand, 800 feet.
Best oil, 818 feet.
Total depth, 837 feet.
First 24 hours production, 75 barrels.
Second 24 hours production, 25 barrrels.

WELL No. 6.

Farm of F. J. Harris, Sec. 1, Turman Township, Sullivan County, 200 feet from E. line, 200 feet from S. line.

Contractor, Frank Breech.
Commenced drilling February 27, 1914.
Completed drilling March 6, 1914.
Casing, 544 feet of 6¼ inch.
Four feet coal at 110 feet.
Five feet coal at 205 feet.
Six feet coal at 520 feet.
Top sand, 640 feet.
Best oil, 640 feet.
Total depth, 691½ feet.
First 24 hours production, 200 barrels.
Second 24 hours production, 175 barrels.

WELL No. 7.

Farm of F. J. Harris, Sec. 1, Turman Township, Sullivan County, 460 feet from S. line, 200 feet from W. line.

Contractor, Frank Branderberry.
Commenced drilling February 26, 1914.
Completed drilling March 2, 1914.
Casing, 560 feet of 6¼ inch.
Top sand, 630 feet.
Best oil, 635 feet.
Total depth, 683 feet.
First 24 hours production, 80 barrels.
Second 24 hours production, 60 barrels.

WELL No. 8.

Farm of F. J. Harris, Sec. 1, Turman Township, Sullivan County, 200 feet from N. line, 1,120 feet from E. line.

Contractor, Jesse Huggins.
Commenced drilling February 24, 1914.
Completed drilling March 4, 1914.
Casing, 545 feet of 6¼ inch.
Top sand, 648 feet.
Best oil, 648 feet.
Total depth, 683 feet.
First 24 hours production, 40 barrels.
Second 24 hours production, 35 barrels.

WELL No. 2.

Farm of Emma Scott, Sec. 36, Turman Township, Sullivan County, 200 feet from N. line, 710 feet from E. line.

Contractor, Smith and Williams.
Commenced drilling February 14, 1914.
Completed drilling March 4, 1914.
Casing, 700 feet of 6¼ inch.
Coal 95 to 100 feet.
Coal 285 to 290 feet.
Coal 330 to 335 feet.
Coal 440 to 445 feet.
Coal 560 to 565 feet.
Coal 680 to 684 feet.
Top sand, 754 feet.
Best oil, 660 feet.
Total depth, 794 feet.
First 24 hours production, 85 barrels.
Second 24 hours production, 72 barrels.

WELL No. 4.

Farm of Alex Raley, Sec. 33, Turman Township, Sullivan County, 155 feet from E. line, 1,085 feet from S. line.

Contractor, F. E. Branderberry.
Commenced drilling February 26, 1914.
Completed drilling March 9, 1914.
Casing, 719 feet of 6¼ inch.
Coal 85 to 90 feet.
Coal 270 to 275 feet.
Coal 330 to 334 feet.
Coal 580 to 585 feet.
Coal 629 to 635 feet.
Top sand, 737 feet.
Best oil, 740 feet.
Total depth, 761 feet.
First 24 hours production, 95 barrels.
Second 24 hours production, 50 barrels.

WELL No. 9.

Farm of H. Heim, Sec. 36, Fairbanks Township, Sullivan County, 660 feet from S. line, 200 feet from W. line.

Contractor, F. F. Williams.
Commenced drilling March 12, 1914.
Completed drilling March 22, 1914.
Casing, 580 feet of 6¼ inch.
Five feet coal at 180 feet.
Five feet coal at 440 feet.
Three feet coal at 560 feet.
Top sand, 450 feet.
Best oil, 618 feet.
Total depth, 650 feet.
First 24 hours production, 60 barrels.
Second 24 hours production, 50 barrels.

WELL No. 3.

Farm of Emma Scott, Sec. 36, Turman Township, Sullivan County, 200 feet from N. line, 1,120 feet from E. line.

Contractors, Smith & Williams.
Commenced drilling March 11, 1914.
Completed drilling March 21, 1914.
Casing, 730 feet of 6¼ inch.
Coal 110 to 115 feet.
Coal 280 to 285 feet.
Coal 340 to 346 feet.
Coal 580 to 586 feet.
Top sand, 768 feet.
Best oil, 775 feet.
Total depth, 790 feet.
First 24 hours production, 75 barrels.
Second 24 hours production, 50 barrels.

WELL No. 4.

Farm of J. V. Merrill, Sec. 35, Fairbanks Township, Sullivan County, 200 feet from E. line, 1,080 feet from S. line.

Contractor, Lawrence Henderhan.
Commenced drilling March 12, 1914.
Completed drilling, March 23, 1914.
Casing, 596 feet of 6¼ inch.
Coal 70 to 73 feet.
Coal 175 to 180 feet.
Coal 225 to 228 feet.
Top sand, 658 feet.
Best oil, 660 feet.
Total depth, 670 feet.
First 24 hours production, 125 barrels.
Second 24 hours production, 120 barrels.

WELL No. 10.

Farm of F. J. Harris, Sec. 1, Turman Township, Sullivan County, 660 feet from E. line, 200 feet from S. line.

Contractor, Frank Breech.
Commenced drilling, March 14, 1914.
Completed drilling March 25, 1914.
Casing, 608 feet of 6¼ inch.
Coal 110 to 113 feet.
Coal 150 to 154 feet.
Coal 280 to 287 feet.
Coal 512 to 521 feet.
Top sand, 645 feet.
Best oil, 650 feet.
Total depth, 690 feet.
First 24 hours production, 40 barrels.
Second 24 hours production, 30 barrels.

WELL No. 3.

Farm of C. E. Merrill, Sec. 36, Fairbanks Township, Sullivan County, 200 feet from S. line, 810 feet from W. line.

Contractor, Heim Drilling Company.
Commenced drilling March 26, 1914.
Completed drilling April 17, 1914.
Casing, 610 feet of 6¼ inch.
Coal 175 to 180 feet.
Coal 226 to 230 feet.
Coal 425 to 427 feet
Top sand, 661 feet.
Best oil, 661 feet.
Total depth, 685 feet.
First 24 hours production, 60 barrels.
Second 24 hours production, 50 barrels.

WELL No. 8.

Farm of Alex. Raley, Sec. 33, Turman Township, Sullivan County, 1,685 feet from S. line, 600 feet from W. line.

Contractor, F. E. Branderberry.
Commenced drilling March 24, 1914.
Completed drilling April 2, 1914.
Casing, 720 feet of 6¼ inch.
Coal 36 to 365 feet.
Coal 600 to 605 feet.
Coal 635 to 640 feet.
Top sand, 767 feet.
Best oil, 768 feet.
Total depth, 784 feet.
First 24 hours production, 100 barrels.
Second 24 hours production, 80 barrels.

WELL No. 4.

Farm of Emma Scott, Sec. 36, Turman Township, Sullivan County, 660 feet from N. line, 660 feet from E. line.

Contractor, H. H. Greenlee.
Commenced drilling April 14, 1914.
Completed drilling April 23, 1914.
Casing, 725 feet of 6¼ inch.
Coal 110 to 115 feet.
Coal 282 to 287 feet.
Coal 342 to 348 feet.
Coal 582 to 588 feet.
Top sand, 763 feet.
Best oil, 775 feet.
Total depth, 787 feet.
First 24 hours production, 70 barrels.
Second 24 hours production, 40 barrels.

WELL No. 5.

Farm of M. J. Beard, Sec. 36, Fairbanks Township, Sullivan County, 200 feet from E. line, 660 feet from S. line.

Contractor, F. F. Williams.
Commenced drilling March 30, 1914.
Completed drilling April 15, 1914.
Casing, 592 feet of 6¼ inch.
Coal 215 to 220 feet.
Coal 310 to 314 feet.
Coal 450 to 455 feet.
Top sand, 629 feet.
Best oil, 629 feet.
Total depth, 668 feet.
First 24 hours production, 60 barrels.
Second 24 hours production, 50 barrels.

WELL No. 2.

Farm of E. T. Osborne, Sec. 1, Turman Township, Sullivan County, 200 feet from N. line, 660 feet from E. line.

Contractor, F. E. Branderberry.
Commenced drilling April 8, 1914.
Completed drilling April 15, 1914.
Casing, 589 feet of 6¼ inch.
Coal 172 to 178 feet.
Coal 300 to 305 feet.
Coal 460 to 465 feet.
Top sand, 665 feet.
Best oil, 666 feet.
Total depth, 742 feet.
First 24 hours production, 40 barrels.
Second 24 hours production, 25 barrels.

WELL No. 5.

Farm of J. V. Merrill, Sec. 35, Fairbanks Township, Sullivan County, 200 feet from E. line, 660 feet from S. line.

Contractor, Lawrence Henderhan.
Commenced drilling March 30, 1914.
Completed drilling, April 10, 1914.
Casing, 590 feet of 6¼ inch.
Coal 70 to 74 feet.
Coal 170 to 175 feet.
Top sand, 645 feet.
Best oil, 645 feet.
Total depth, 666 feet.
First 24 hours production, 140 barrels.
Second 24 hours production, 140 barrels.

WELL No. 1.

Farm of William Strain, Sec. 9, Turman Township, Sullivan County, 200 feet from N. line, 200 feet from W. line.

Contractor, C. C. Kirk.
Commenced drilling April 17, 1914.
Completed drilling April 27, 1914.
Casing, 642 feet of 6¼ inch.
Coal 180 to 183 feet.
Coal 475 to 480 feet.
Top sand, 680 feet.
Best oil, 683 feet.
Total depth, 708 feet.
First 24 hours production, 60 barrels.
Second 24 hours production, 50 barrels.

WELL No. 9.

Farm of Alex. Raley, Sec. 33, Turman Township, Sullivan County, 1,075 feet from S. line, 210 feet from W. line.

Contractor, F. E. Branderberry.
Commenced drilling April 15, 1914.
Completed drilling April 23, 1914.
Casing, 715 feet of 6¼ inch.
Coal 300 to 306 feet.
Coal 360 to 366 feet.
Coal 385 to 390 feet.
Coal 642 to 648 feet.
Top sand, 772 feet.
Best oil, 774 feet.
Total depth, 792 feet.
First 24 hours production, 90 barrels.
Second 24 hours production, 75 barrels.

WELL No. 11.

Farm of F. J. Harris, Sec. 1, Turman Township, Sullivan County, 660 feet from E. line, 660 feet from S. line.

Contractor, Frank Breech.
Commenced drilling March 29, 1914.
Completed drilling April 15, 1914.
Casing, 586 feet of 6¼ inch.
Coal 145 to 150 feet.
Coal 395 to 400 feet.
Coal 415 to 418 feet.
Top sand, 638 feet.
Best oil, 638 feet.
Total depth, 686 feet.
First 24 hours production, 60 barrels.
Second 24 hours production, 50 barrels.

WELL No. 7.

Farm of J. V. Merrill, Sec. 35, Fairbanks Township, Sullivan County, 660 feet from E. line, 660 feet from S. line.

Contractor, Lawrence Henderhan.
Commenced drilling April 22, 1914.
Completed drilling April 29, 1914.
Casing, 592 feet of 6¼ inch.
Coal 220 to 225 feet.
Coal 435 to 437 feet.
Coal 550 to 553 feet.
Top sand, 645 feet.
Best oil, 645 to 664 feet.
Total depth, 677 feet.
First 24 hours production, 160 barrels.
Second 24 hours production, 150 barrels.

WELL No. 4.

Farm of Wyatt Dix, Sec. 36, Fairbanks Township, Sullivan County, 200 feet from N. line, 200 feet from E. line.

Contractor, F. F. Williams.
Commenced drilling April 18, 1914.
Completed drilling May 5, 1914.
Casng, 679 feet of 6¼ inch.
Coal 220 to 225 feet.
Coal 310 to 315 feet.
Coal 495 to 497 feet.
Top sand, 681 feet.
Best oil, 681 feet.
Total depth, 711 feet.
First 24 hours production, 20 barrels.
Second 24 hours production.

WELL No. 3.

Farm of E. T. Osborne, Sec. 1, Turman Township, Sullivan County, 660 feet from S. line, 200 feet from W. line.

Contractor, F. E. Branderberry.
Commenced drilling April 25, 1914.
Completed drilling May 5, 1914.
Casing, 570 feet 6¼ inch.
Coal 130 to 135 feet.
Coal 305 to 310 feet.
Coal 470 to 475 feet.
Top sand 622 feet.
Best oil, 622 to 627 feet.
Total depth, 697 feet.
First 24 hours production, 20 barrels.
Second 24 hours production, 20 barrels.

WELL No. 3.

Farm of J. T. Alkire, Sec. 1, Turman Township, Sullivan County, 660 feet from E. line, 200 feet from N. line.

Contractor, Jesse Huggins.
Commenced drilling April 26, 1914.
Completed drilling May 5, 1914.
Casing, 570 feet of 6¼ inch.
Coal 120 to 125 feet.
Coal 160 to 163 feet.
Coal 450 to 453 feet.
Coal 550 to 557 feet.
Top sand, 670 feet.
Best oil, 675 to 685 feet.
Total depth, 694 feet.
First 24 hours production, 20 barrels.
Second 24 hours production, 17 barrels.

The so-called "pools" of Sullivan County are named and located as follows:

Shelburn pool, three miles west of the town of Shelburn.
Jamison pool, two and one-half miles west of Sullivan.
Denny pool, five miles west of Sullivan.
Rinkston pool, four miles southwest of Shelburn.

These are the principal oil-producing areas of Sullivan County, and the total daily production June 1st was 3,500 barrels. Between forty and fifty drilling outfits were drilling in Sullivan County at the above date. A total of 400 wells had been drilled in the fourteen months preceding June 1, 1914, of which 225 are producers of from 5 to 250 barrels each, 165 dry holes, and 10 gas producers.

First producing oil well in the county was drilled by the Hamilton Gas and Oil Co. of Sullivan, Indiana, on the W. C. Jamison farm, Section 31, Hamilton Township, in April, 1906.

POSSIBLE DANGERS FROM OIL AND GAS WELLS IN COAL MEASURES.

It is only within the last year that the State of Indiana has been brought face to face with the problem set forth in the above heading. Hitherto oil and gas exploitations have been in areas in Indiana far removed from her coal measure rocks.

The old Trenton rock field of the State is at least forty miles east of the eastern margin of the productive coal area of the State.

Shallow, small producing, and short-lived oil and gas wells have been drilled in the Niagara rocks of southeastern Indiana, and the Genesee and Corniferous nearby, but these are farther removed from the coal measures than the old Trenton field.

A small field, known in Indiana as the Oakland City field, lying well on the southeastern margin of the coal fields, and covering an area of about thirty-five or forty square miles, has been developed in the past five years, but as few coal seams were penetrated in drilling, the problem of danger has never demanded public attention. Again, the great Phoenix oil well located in the center of the city of Terre Haute, Indiana, and the greatest producing well ever struck in Indiana, penetrated the coal measures, but as subsequent drilling in the vicinity resulted in dry holes, the attending dangers of drilling in the Carboniferous never attracted public attention. But within the last twelve months oil and gas development has been in progress in Sullivan County, Indiana, com-

prising an area of some four or five hundred square miles and lying wholly within the coal measures. Public attention is now fixed on the possible dangers to mine operations from the presence of drill holes. The anxiety, if I may use the term, is intensified by the fact that the laws of the State hitherto made concerning the plugging or sealing of wells related almost entirely to the question of the *waste* of *gas* from abandoned wells, that is, wells from which the owners expected to draw the pipe to use elsewhere, or to sell. Incidentally the law protects the fresh water supply of a community from contamination by the salt water from oil and gas wells. The law in Indiana relating to the sealing of oil and gas wells, and based wholly on the propositions of *waste* and *contamination* is not adequate to meet the present contingency. The section of the law relating to those two results reads as follows:

> "Section 1. Be it enacted by the General Assembly of the State of Indiana, That before the casing shall be drawn from any well drilled into gas or oil-bearing rock for the purpose of abandoning the same, it shall be the duty of any person, firm or corporation having the custody of such well, or having charge of removing the casing therefrom for the purpose of abandoning the same, at the time of such abandonment, to properly and securely stop and plug each of said wells so abandoned in the following manner: Such hole shall first be solidly filled from the bottom thereof to a point at least twenty-five (25) feet above such gas or oil-bearing rock with sand, gravel or pulverized rock, on the top of which filling shall be seated a dry pine wood plug not less than two (2) feet long and having a diameter of one-fourth of an inch less than the inside diameter of the casing in such well; above such wooden plug such well shall be solidly filled for at least twenty-five (25) feet with the above mentioned filling material; immediately above this shall be seated another wooden plug of the same kind and size as above provided, and such well shall again be solidly filled for at least twenty-five (25) feet above said second plug with such filling material. After the casing has been drawn from such well there shall immediately be seated at the point in said well where such casing was seated a cast-iron ball, the diameter of which ball shall be greater than that of the hole below the point where such casing was seated, and above such ball such well shall again be solidly

filled with the above mentioned filling material for a distance of fifty (50) feet."

This law and manner of sealing oil and gas wells is inadequate for conditions in the productive coal measures of Indiana. A law should be formulated based on the following relations between coal mines and oil and gas wells:

1. Protection to open coal workings.
2. Protection to inaccessible spaces.
3. Pillars, or coal that may be left as pillars.
4. Protection to future mining operations.

The dangers attending the drilling of oil and gas wells through workable coal seams may be enumerated as follows:

1. Loss of human life.
   (a) By suffocating gases.
   (b) By explosion.
2. Destruction of property.
   (a) The mine itself.
   (b) Machinery and improvements.
3. Depreciation of coal property on account of proximity to oil or gas wells.

It is well known that the most common form of accident in coal mines is by the explosion of gases accumulated in the mine. Four-fifths of the mine accidents in Indiana are due to this cause, and there will be added danger and increased loss of life and property if protection is not afforded mine operations from possible leakage of gas from oil or gas wells. So far as I know there have been no accidents or explosions as yet in Indiana from this cause. Within the last year more than five hundred wells have been driven in Indiana through workable coal seams.

Dr. R. R. Hice of Pennsylvania says of this same condition in Pennsylvania:

> "It would seem that a great mine disaster directly due to some improperly operated or protected well is needed to arouse public sentiment and cause the enactment of laws which will probably be more drastic than is demanded, and this fact is recognized by some of the more advanced and broader operators."

At a meeting of coal operators, oil and gas operators, coal mine inspectors and state geologists, held in Pittsburgh, Pa., last February, the formation of a law regulating the location, drilling, operating and abandonment of oil and gas wells, especially those passing through workable coal beds, was carefully considered. It is not necessary to enumerate the mine accidents reported at this conference, due directly or indirectly to wells. It does not seem probable that all such accidents were reported. The greatest reported loss of life due to an explosion from a leaking gas well was 29, and many others were reported where the attending loss of life was from two to a half dozen.

The center of activity in oil and gas drilling in Indiana today is within our productive coal measures area. With the increased demand for oil, the drilling of wells will continue. "In June of this year, according to the Oil City Derrick, west of the Mississippi in the Mid-Continent and Texas and Louisiana fields 2,327 wells; in July, 2,342 wells, and in August 2,381 wells were completed. East of the Mississippi in July 1,067 and in August 1,109 wells were finished, and at the end of August 513 wells were in process of drilling. This makes a total of nearly 10,000 wells for the Mid-Continent territory. When we consider that we have no record of the location of any of these wells now drilling, of those in operation, or of the many thousands which have been abandoned, we must all agree that the business is one that has been allowed to take care of itself. Under such conditions, it is not necessary to say anything regarding the necessity of regulation and inspection if we are to prevent the reckless destruction of producing territory by irresponsible operators; to prevent damage to mines and loss of life through improper locating and wrong methods of drilling and casing new wells and improper plugging of old ones, and to prevent the unnecessary pollution of surface waters."

At the Pittsburgh conference there was naturally some differences in opinion as to how far such laws should reach. Some coal men seemed to think that absolutely no well should be allowed to be drilled through any bed of coal which might at any time be mineable, while on the other hand some oil operators seemed to think any regulation whatever was an interference with their right to carry on their own business. Naturally these extreme ideas were not urged to any extent in the meeting; but they existed. It was generally recognized, however, that the coal and oil and gas represented distinct and separate estates, each of which was pos-

sessed of certain rights, and each under the burden of certain restrictions as regard to the other.

The results of the deliberations at the Pittsburgh conference are summed up briefly by Dr. Hice as follows:

"1. Accurate and formal location and recording of wells.
"2. Co-operation of the several parties interested to obtain a safe location.
"3. Designation of effective methods of casing and protecting wells through coal beds.
"4. Formal abandonment of wells.
"5. Safe methods of plugging wells.
"6. Adequate inspection."

There is a law on our statute books that compels the operator of each coal mine to make a map of such mine, the principal requirements of which are as follows:

1. An accurate plan of the workings in minute detail.

2. A copy of the map shall be put in the hands of the State Mine Inspector, and a copy be kept at the office of the mine for inspection by anyone interested.

3. The map shall be revised and extended the first day of May and the first day of September of each year, so as to include all extensions in the workings.

4. All expenses in connection with such map shall be paid by the operator.

5. In event of failure of operator to make such map, the State Mine Inspector shall make a survey and map, and the expense of the same shall be a lien on the mine property.

It would seem that this law compelling the mapping of coal mines is adequate for all practical purposes.

There is no law in Indiana compelling oil or gas operators to make maps of the areas they are developing, or the location of proposed wells. The principal protection afforded the people are the records made in the report of the State Geologist as to the geographical location of oil and gas wells. That a law compelling the mapping of oil and gas territory and the exact location of all drillings by operators is needed in Indiana goes without saying. The details of the manner of sealing or plugging oil or gas wells drilled through workable coal seams is yet to be worked out.

The general plan is as follows:

1. That the drill hole shall penetrate the rock thirty feet below the lowest coal seams.

2. That the drill hole shall be from one to three inches larger in diameter than the outer casing, and this space shall be filled with cement.

3. That there shall be several casings of different sizes with spaces between, some of which are to be filled with cement.

4. That one of such spaces shall be open to permit the exit of accumulated gas at the top.

5. That these casings shall be surmounted by a top to prevent the influx of surface water.

That a cone of cement shall protect the casing when extended through an open working.

If it shall be found to be impossible to pass a law embodying the best of the above suggestions, then there is but one thing left to do, and that is, when a well is to be abandoned, fill it from bottom to top with cement.

In concluding his report on the Pittsburgh conference, Dr. Hice says:

"It is certain that changes will be made in the suggested regulations before enacted into a law in any State, but that it is important, and of increasing importance, to every State where oil and gas is or may be produced is without question. It will entail a very considerable expense upon the industry, but less relatively than is forced upon the coal interests by the laws regulating the mining of coal. The industry is a large one, and the necessity for conserving it is becoming daily more apparent, and the expense to the State will be many times returned in the taxes paid by the business. It will be due, however, to the friends of conservation, to those who want to see our resources used, but used intelligently, and desire to prevent the present waste and loss of life, to see that some such legislation is passed. It will be their duty to reconcile the divergent views of the opposed interests, to point out to them that such regulations mean not loss, but gain, that will secure the passage of the required laws by the several legislative bodies in the states concerned."